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NEW CLAIMS

1. Method for determining the precompensated pattern of exposure doses of an electron beam required per pattern position to obtain a desired pattern in a coating on a substrate, comprising of:

- determining the smearing function of the electron beam;

- determining the precompensated pattern with the smearing function and the desired pattern, wherein the determination is performed such that the exposure doses contain almost exclusively positive values and that the exposure doses are smooth relative to each other, wherein the step of determining the precompensated pattern comprises the steps of:

a) estimating a regularization parameter;

b) determining a precompensated pattern with all pattern points of the desired pattern with the exception of a determined pattern point;

c) smearing the precompensated pattern again with the smearing function in order to predict the dose of the determined pattern point;

d) repeating steps b and c for each pattern point;

e) repeating steps a to d with adapted regularization parameter until a final value of a regularization parameter is obtained;

f) determining the precompensated pattern with the final value of the regularization parameter.

2. Method as claimed in claim 1, wherein step b) comprises the following iterative definition:

$$d^{(l)} = d^{(l-1)} + (K^*K+\lambda B(D))^{-1}K^*r^{(l-1)} \qquad r^{(l)} = a-Kd^{(l)}$$

with $d^{(0)} = 0$ and $r^{(0)} = a$

wherein a is a vector with the doses of the desired pattern as elements, d is a vector with the exposure doses of the precompensated pattern, K is the smearing function in matrix form, K^* is the Hermitian conjugate of the smearing function K, B is an operator and λ a regularization parameter.

3. Method as claimed in claim 2, wherein the operator B is defined as follows:

$$B(D) = \sum_i \left(\frac{d_i}{d_{tot}}\right) \ln\left(\frac{d_i}{d_{tot}}\right)$$

in which the summation takes place over all pattern points, d_i is the i^{th} element of the vector d, and d_{tot} represents the summation over all elements of the vector d.

4. Method as claimed in claim 1, wherein the final value of the regularization parameter in step e) is the regularization parameter wherein

$$\frac{1}{N}\sum_{k=1}^{N} (a_k - [Kd_k(\lambda)]_k)^2$$

wherein N is the total number of pattern points, a is a vector with the doses of the desired pattern as elements, d is a vector with the exposure doses of the precompensated pattern and K the smearing function in matrix form.

5. Method as claimed in claim 1, wherein the &6nal value of the regularization parameter in step e) is the minimal regularization parameter wherein N

$$\frac{1}{N}\sum_{k=1}^{N} (a_k - [Kd^k(\lambda)]_k)^2 w_{kk}(\lambda)$$

is the total number of pattern points, a is a vector with the doses of the desired pattern as elements, d is a

vector with the exposure doses of the precompensated pattern, K is the smearing function in matrix form and w_{kk} is defined as:

$$w_{kk}(\lambda) = \left[\frac{1-a_{kk}(\lambda)}{1-\frac{1}{N}\sum_{j=1}^{N} a_{jj}(\lambda)}\right]^2$$

with a_{kk} the elements of the matrix $A = K(K^TK+\lambda L(D)^TL(D))^{-1}K^T$ and L the Laplace operator.

6. Method as claimed in any of the foregoing claims, wherein after step e) the step is performed of training a neural network using one or more desired first patterns and the associated precompensated patterns.

7. Method as claimed in claim 6, wherein the precompensated pattern associated with a second desired pattern can be determined with the trained neural network.

8. Method as claimed in claims 6 and 7, wherein the first desired pattern is a relatively simple training pattern and the second desired pattern is the partial pattern of an integrated circuit.

9. Method as claimed in claim 8, wherein two or more partial patterns can be combined into a composite pattern of the integrated circuit.

10. Method as claimed in any of the claims 6-9, wherein the neural network is a radial base function network.

11. Method as claimed in any of the claims 6-10, wherein the neural network is implemented in hardware.

12. Method as claimed in claim 11, wherein the neural network is implemented in analog hardware.

13. Method as claimed in any of the foregoing claims, wherein the smearing function is made up of at least two Gaussian functions.

14. Method as claimed in claim 13, wherein an exponential function is added to the smearing function.

15. Method as claimed in claim 13 or 14, wherein the parameters of the Gaussian functions can be determined using statistical simulations.

16. Method as claimed in claim 13 or 14, wherein the parameters of the Gaussian functions can be determined by measurements.

17. Device for determining the exposure dose of an electron beam required per pattern position to obtain a desired pattern in a coating on a substrate, comprising electronic circuit means for implementing a neural network with weighting factors determined as claimed in any of the foregoing claims.

18. Integrated circuits manufactured with the device of claim 17 or according to the method of any of the claims 1-16.